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Analysis of "code blue" application and results: a single center experience

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ABSTRACT

Aim: This study was prepared to analyze the "Code Blue" application and results in Hitit University Erol Olçok Training and Research Hospital.

Material and Method: Whole of the code blue calls issued in our hospital in 2019 were retrospectively examined and evaluated within the framework of the necessary legal permissions. In this context, arrival time of the code blue team at the scene, CPR performance, duration, results of application and demographic information of patient, place, date and time data were collected. The obtained data were analyzed using the SPSS (Statistical Package for Social Science).

Results: Between 01.01.2019 and 31.12.2019 a total of 748 code blue notifications were evaluated. The average time for the blue code team to reach the patient was 2.06 minutes. Code blue call was made mostly in intensive care units, by nurses and in January. Patients who underwent code blue intervention 55.89% of them were male and 44.11% were female. Code blue calls were requested the most was the range of 61-80 ages. The oldest patient who received CPR was 105 years old, and the youngest was 2 years old. Besides, code blue call reason is most respiratory+cardiac arrest (243), cardiac arrest (199) and respiratory arrest (109). The results of the whole code blue interventions in 2019, it was figured out that 401 of the patients were dead, 135 of them were taken into intensive care, 173 of them were monitored in the service, 25 people were transferred to the emergency, 12 calls were wrong calls and 2 calls for exercise.

Conclusion: The internationally determined intervention period for the patient to not lose his vital functions to survive is 2 -5 minutes. As a result, code blue application in our hospital has been successfully implemented in accordance with the standards, with effective and rapid intervention.

Keywords: Code blue, cardiopulmonary arrest, survival, patient safety

INTRODUCTION

Today much progress has been made in terms of patients, patient rights and quality of care all over the world. For this purpose, new regulations and rules are being implemented by different countries. Although many countries have different standards and practices, "code blue" which indicates cardiac or respiratory arrest is used as a common medical emergency code throughout the world. And, code blue was used for the first time in the USA. In our country, code blue applications started to be implemented for the first time in 2008 within the scope of health transformation with service quality standards. Its implementation has been made compulsory in all health institutions in the scope of the Regulation on Ensuring Patient and Employee Safety made by the Ministry of Health with the regulation no 27214 and 9489 in 2009 and 2011, respectively (1).

Code blue is the international emergency code applied by a professional team to secure the basic life support process of patients who develop cardiac and/or respiratory arrest and need emergency medical attention. Patients whose basic life functions at risk such as breathing and circulation need immediate intervention is done by code blue team. That professional team at all levels receives training at regular intervals and constantly controlled has been constituted with blue code standards. In this way, critical interventions are carried out professionally by a trained and specific team according to certain standards. Besides, the emergency number of code blue is set as "2222" by the Ministry of Health.

Code blue team formed with experienced doctors, nurses and other health personnel trained in cardiopulmonary

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resuscitation (CPR). After the emergency code blue call, the code blue team arrives at the scene as soon as possible and applies CPR immediately when necessary. All information in this process is recorded in the code blue notification form. Thus, the whole process and its results become traceable.

MATERIAL AND METHOD

The study was carried out with the permission of Scientific Researches Ethics Committee of Hitit University (Date: 29.06.2020, Decision No: 2020/73). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

In recent years, studies on the code blue application and its results have been carried out in many different hospitals. Hence, the strengths and weaknesses that arise in practices in different hospitals are revealed. By evaluating the results which are important in terms of guiding other hospitals, the failing aspects of the processes and the steps to be taken for improvement can be determined. In this study, the code blue application and results in 2019 at the Hitit University Erol Olçok Training and Research Hospital were analyzed.

This study was carried out at Hitit University Erol Olçok Training and Research Hospital which was replaced in its new location in 2017 and enlarged (422 rooms and 650 beds) in line with the needs. Code blue application was first started in our hospital in 2011. And this study was conducted by retrospectively analyze the code blue notification forms and records for 2019. The code blue notification form includes the patient's age, gender, scene and time of the event, arrival time of code blue team, patient intervention time and results.

Statistical Analysis

The data were analyzed with the SPSS statistical package program, and error controls, tables and statistical analyzes were made. In statistical evaluations, percentage, mean, chi-square test for categorical data according to the characteristics of the variables, t-test/Mann Whitney-U test, One-Way ANOVA/ Kruskall Wallis tests were used for measurement data. Tukey's HSD test/Mann Whitney U test will be used to determine the differences between groups in these tests. Pearson correlation analysis will be used in case of normal distribution, in the contrary case Spearman correlation analysis will be used. Means (Mean.) were given together with standard deviation (SD) (Mean±SD), $p<0.05$ was considered statistical significance. In addition, all other information, documents and experiences gained during the code blue implementation process were evaluated.

RESULTS

In this study, 748 code blue calls were assessed between January 1, 2019 - December 31, 2019. Among them, 330 (44.11%) were female and 418 (55.89%) were male. And, the age ranges of patients who were given a blue code call are as in **Figure 1**. The number of patients between the ages of 61-80 constitutes 51.87% (388) of the total number of patients. On the other hand, the number of patients in the 0-20 age range is only 4%. As can be seen from Figure1, there are many critical cases in patients over 60 years and that cases should be carefully considered. Besides, The youngest age at which CPR was applied in the code blue call was a 2 years old baby boy (alive) and the oldest age was a 105 years old female (ex).

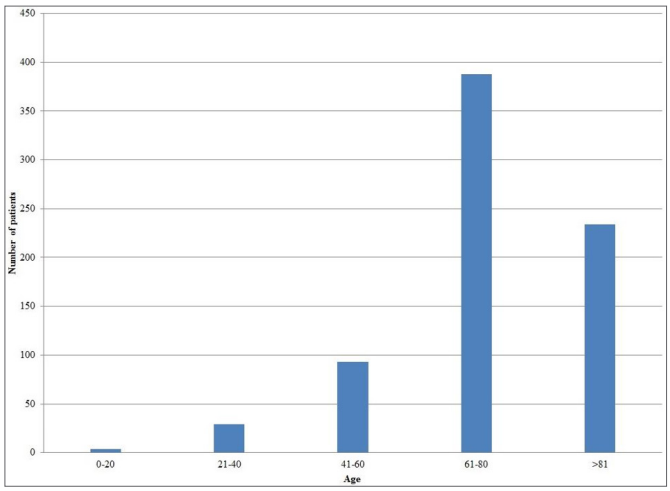

Figure 1. Age range of patients

The monthly distribution of response times to code blue calls is shown in **Figure 2**. Average response time is 2.06 minutes and it can be seen from figure this rate partially below 1 minute and in some cases reaches to 3 minutes.

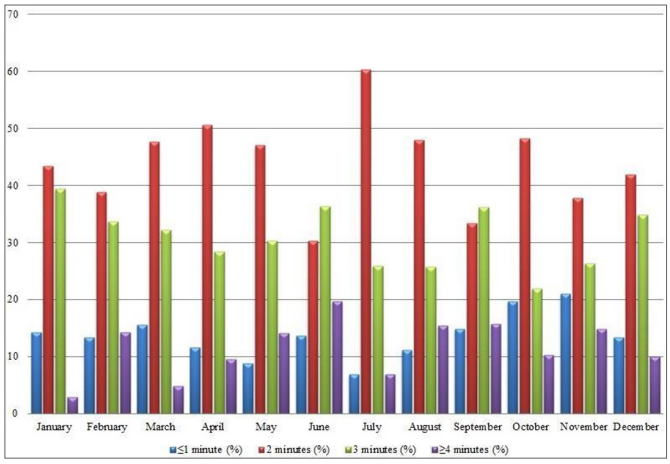

Figure 2. Monthly intervention (response) time

When obtained data were analyzed periodically, average response time was 1.99 minutes for the shortest 1st quarter and 2.16 minutes for the longest 2nd quarter. **Table 1** shows the average intervention times on a periodic (quarterly) basis.

When the total annual cases are examined, the intervention rate under <1 minute is 13.65%, the rate of intervention in <2 minutes is 43.98%, the rate of intervention in <3 minutes is 30.99%, and the rate of >4 is 11.5%. Results show that the intervention time periods are within the internationally predetermined time intervals. A statistically significant relationship was found between the intervention time and the quarters ($\chi2$=27,573; p=0,001). 81 cases (38.4%) that were intervened in <1 minutes were in the 4th quarter, 194 cases (29.0%) that were intervened in <2 minutes in the 4th quarter, 129 cases (27.0%) that were intervened in <3 minutes in the 1st quarter and It was determined that 56 cases (32.0%) that were intervened in 4 minutes/more were in the 2nd quarter. In addition, it was observed that nearly half (50.8%) of the code blue calls from intensive care services, such as internal medicine intensive care, coronary intensive care, surgical intensive care and angio intensive care services. Also, 42% of the code blue calls from services. And that calls were mostly made by nurses.

With the information given in **Table 2**, code blue calls were analyzed according to units. A statistically significant difference was found in terms of the number of codes blue calls according to the units (p=0.018). As a result of pairwise comparisons with Bonferroni correction made to determine which group the significant difference originated from; Statistically significant difference was determined between the code blue numbers coming from the service, polyclinic and single units. The number of codes blue coming from the service is statistically significantly higher than those coming from polyclinic and single units.

Table 2. Comparison of code blue calls by units

Unit	Code blue calls		Statistical analysis* probability
	$\bar{x}$±S.S	Median [Min-Max]	
Service	37.11±55.17	10.0 [1.0-213.0]	$\chi2$=7.996
Polyclinic	1.80±0.84	2.0 [1.0-3.0]	p=0.018
Single units	3.78±2.68	3.0 [1.0-9.0]	[1-2.3]

* "Kruskal-Wallis H" test ($\chi2$-table value) statistics are used to compare the measurement values of three or more independent groups in non-normally distributed data.

The results given to the blue code calls in our hospital are shown in **Table 3**. 93 (12.4%) of the code blue call requests were not intervened and the remaining 655 (87.6%) requests were intervened in the form of CPR, intubation or drug treatment.

When the blue code calls were analyzed in 3-month periods (quarter): a statistically significant relationship was found between the intervention status and the quarters ($\chi2$=16.683; p=0.001) as seen in **Table 4**. It was determined that 46 codes blue (49.5%) given in the non-intervention group were given in the 4th quarter, while in the intervention group, 164 codes blue (25.0%) were given in the 1st quarter. In the non-intervention group, the rate of code blue calls in the 4th quarter was found to be significantly higher than in the 1, 2 and 3rd quarters. It was determined that approximately 25% of the codes blue were given in each period when the distributions were homogeneous in the intervention group.

Table 1. Relationship between intervention time and quarterly

	n	%	n	%	n	%	n	%	n	%	
Quarterly											
1.	51	24.2	154	23.1	129	27.0	23	13.1	357	23.3	
2.	42	19.9	158	23.7	120	25.2	56	32.0	376	24.6	$\chi2$=27.573
3.	37	17.5	162	24.2	99	20.8	43	24.6	341	22.3	p=0.001
4.	81	38.4	194	29.0	129	27.0	53	30.3	457	29.8	

*Pearson-$\chi2$ crosstabs were used to examine the relationships between two qualitative variables.

Table 3. Summary of code blue calls

Not-intervened	8	3	4	2	3	13	5	1	8	10	14	22	93
CPR+intubation +drug treatment	79	44	41	43	65	48	50	54	43	63	63	62	655
Number of processed calls	87	47	45	45	68	61	55	55	51	73	77	84	748
Observation in the service	31	9	16	14	10	10	12	13	8	26	20	4	173
Transferrring to intensive care service	10	11	6	3	12	7	7	6	11	11	11	40	135
EX	42	24	21	28	40	36	34	34	27	34	43	38	401
Transferring to emergency polyclinic	4	3	1	0	6	1	1	2	3	1	2	1	25
Wrong call	0	0	1	0	0	6	1	0	2	1	1	0	12
Practice	0	0	0	0	0	1	0	0	0	0	0	1	2
Total	87	47	45	45	68	61	55	55	51	73	77	84	748

Table 4. Analysis of relationship between intervention and quarters

	n	%	n	%	n	%	
Quarter							
1.	15	16.1	164	25.0	179	23.9	
2.	18	19.4	156	23.8	174	23.3	χ2=16.683
3.	14	15.1	147	22.5	161	21.5	p=0.001
4.	46	49.4	188	28.7	234	31.3	

*Pearson-χ2 crosstabs were used to assess the relationship between two qualitative variables.

A statistically significant relationship was found between the type of intervention and the quarters (χ2=29.495; p=0.001) as seen in **Table 5**. It was determined that 56 interventions (32.4%) was followed-up in the service, in the 1st quarter, 62 interventions (45.9%) transferred to the intensive care unit in the 4th quarter, 14 interventions (35.9%) of the other types were in the 2nd quarter, and 115 interventions (28.7%) with Exitus were in the 4th quarter. It was determined that the interventions follow-up periods in the service were predominantly in the 1st quarter, the interventions transferred to the intensive care unit and exitus were predominantly in the 4th quarter, and other types of interventions were predominantly in the 2nd quarter.

DISCUSSION

Code blue application which stands out as a very important application in reducing the life risks of patients is mandatory in our country by the Ministry of Health. In addition, code blue application has been an important criterion in terms of health worker, patient safety and service quality standards. As it is known, code blue is a system that regulates the necessary emergency intervention to the patient in case of cardiopulmonary arrest (2). This intervention being done quickly and by a professional team directly affects the patient's chance of survival (3). As a result of the Petrie et al. study is meaningful at this point, patients mortality rate was found to be approximately 100% in cases whose response time exceeded 8 minutes (4). Another remarkable results of the studies are that the chance of survival and the rate of discharge of the patients increase with the early defibration of the code blue team (5-9). Besides, it has been found that the response rate to CPR is between 15-40% in literature, and that intervention in the first 3 minutes increases the patient's chance of survival more (6). Considering the gender status of the patients with code blue, it is seen that it is between 55-70% in male and 30-45% in females (7,9,10). If our study is compared with the literature, it will be seen that the results are similar. As a result of the code blue application carried out throughout 2019, 418 (55.89%) of 748 patients who intervened were male and 330 (44.11%) were female. It is thought that the lower incidence of coronary diseases in women than men indicates the lower number of code blue cases (11, 12). On the contrary, it is possible to see opposite examples in the literature. Such as, 60.08% of patients who underwent code blue intervention are women in Gurman et al. (13) study. In the literature, code blue response time is around 2-3 minutes (14-17). Tosyalı et al. investigated seven code blue studies between 2008 and 2014 to carry out an average response time of 1404 patients was 3.02 minutes which decreased from year to year (18). However, Ozuturk et al. (11) achieved an average arrival time to the scene of 1.10 minutes for 225 patients. But it should also be clarified that the factors affecting the duration are also directly related to the physical structure of the hospital and the locations of the polyclinics. Although the code blue response time is relatively high in big hospitals, the average time of our hospital is 2.06 minutes. Also in our study, interventions were performed for 11 patients in less than 1 minute, 200 patients within 1 minute, 271 patients within 2 minutes, 139 patients within 3 minutes, 21 patients within 4 minutes, and 14 patients within <6 minutes. In CPR applications, the shortest CPR duration is 2 minutes to a 90-year-old intensive care patient/woman (intervention is performed twice, the first is 45 minutes, then intervened again 5-10 minutes later), the longest CPR duration is 50 minutes to 61 years old oncology patient/man .

CONCLUSION

In this study, the application and results of the code blue in Hitit University Erol Olçok Training and Research Hospital were analyzed. With this study, it is aimed to make a positive contribution to the literature by examining and analyzing 748 code blue calls in detail. Within the scope of our literature review, this study evaluated the highest number of calls and results among the code blue studies conducted in our country. In addition, the results are similar between hospitals

Table 5. Assessing the relationship between the type of intervention and the quarters

	n	%	n	%	n	%	n	%	n	%	
Quarter											
1.	56	32.4	27	20.0	9	23.1	87	21.7	179	23.9	
2.	34	19.3	22	16.3	14	35.9	104	25.9	174	23.3	χ2=29.495
3.	33	19.1	24	17.8	9	23.1	95	23.7	161	21.5	p=0.001
4.	50	28.9	62	45.9	7	17.9	115	28.7	234	31.3	

*Pearson-χ2 crosstabs were used to assess the relationship between two qualitative variables.

in general regarding the code blue application in our country, but it is also observed that there is a significant difference in the data obtained according to the parameter differences. In this context, a comprehensive code blue research should be carried out for the whole of Turkey in the future, and the results should be shared and necessary analyzes should be made.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Scientific Researches Ethics Committee of Hitit University (Date: 29.06.2020, Decision No: 2020/73).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

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REFERENCES

1. Ministry of Health, Regulation on Ensuring Patient and Employee Safety, Official Gazette, 2011, R.G: 06/04/2011, number: 27897.
2. Möhnle P, Huge V, Polasek J, et al. Survival after cardiac arrest and changing task profile of the cardiac arrest team in a tertiary care center. Scientific World J 2012; 2012: 294512.
3. İncesu E. Return to life is "blue code" retrospective evaluation of notification reports of blue code section by Seydisehir State Hospital. Usaysad Derg 2018; 4: 26-39.
4. Petrie DA, De Maio V, Stiell IG, Dreyer J. Factors affecting survival after prehospital asystolic cardiac arrest in a basic life support - defibrillation system. CJEM 2001; 3:186-192.
5. Saghafinia M, Motamedi MH, Piryaie M, et al. Survival after in hospital cardiopulmonary resuscitation in a majör referral center. Saudi J Anaesth 2010; 4: 68-71.
6. Herlitz J, Rundqvist S, Bång A, et al. Is there a difference between women and men in characteristics and outcome after in hospital cardiac arrest. Resuscitation 2001; 49: 15-23.
7. Özmete, Ö. Bir üniversite hastanesinde mavi kod uygulamaları. Cukurova Med J 2017; 42: 446-50.
8. Çiçekci, F., Atıcı S. Mavi Kod çağrısına bağlı kardiyopulmoner resüsitasyon uygulamaları sonuçlarının değerlendirilmesi. Genel Tip Derg 2013; 23.
9. Oğuztürk H, Turtay MG, Tekin YK, Sarıhan E. Cardiac arrests in the emergency ward and our experiences on the cardiopulmonary resuscitation. Kafkas J Med Sci 2011; 1: 114-7.
10. Mendes A, Carvalho F, Dias C, Granja C. In-hospital cardiac arrest: factors in the decision not to resuscitate. the impact of an organized in-hospital emergency system. Rev Port Cardiol 2009; 28: 131-41.
11. Özütürk B, Muhammedoğlu N, Dal E, Çalışkan B. Evaluation of blue code interventions outcomes. Haseki Tıp Bülteni 2014; 2276: 204-8.
12. Villamaria JF, Pliego FJ, Wehbe-Janek H, et al. Using simulation to Orient Code Blue Teams to a new hospital facility. Simul Healthc 2008; 3: 209-16.
13. Gürmen ES, Demir B. Investigation of the suitability and outcome of the Blue Code Call System at an University Hospital. Van Tıp Derg 2019; 26: 353-7.
14. Esen O, Esen HK, Öncül S, Gaygusuz EA, Yılmaz M, Bayram E. Code Blue practices and evaluation of results in a training and research hospital. J Kartal TR 2016; 27: 57-61.
15. Sık G, Çıtak A. Evaluation of Code Blue Implementation and Its Outcomes in Pediatric Patients JARSS 2020; 28: 47-51.
16. Murat E, Toprak S, Doğan DB, Mordoğan F. Evaluation of code blue implementation outcomes. Med Sci 2014; 3: 1002-12.
17. Özgür Y, Albayrak MD, Results of the blue code application in chest diseases and chest surgery training and research hospital. J DEU Med 2020; 34: 35-42
18. Tosyalı C, Numanoğlu M. Mavi kod uygulaması algılaması. Sağlıkta Performans ve Kalite Dergisi 2015; 9: 66-77.